

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Nuclear power plants – Instrumentation and control important to safety –  
Development of HDL-programmed integrated circuits –  
Part 2: HDL-programmed integrated circuits for systems performing  
category B or C functions**

**Centrales nucléaires de puissance – Instrumentation et contrôle-commande  
importants pour la sûreté – Développement des circuits intégrés programmés  
en HDL –  
Partie 2: Circuits intégrés programmés en HDL pour les systèmes réalisant  
des fonctions de catégorie B ou C**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Nuclear power plants – Instrumentation and control important to safety –  
Development of HDL-programmed integrated circuits –  
Part 2: HDL-programmed integrated circuits for systems performing  
category B or C functions**

**Centrales nucléaires de puissance – Instrumentation et contrôle-commande  
importants pour la sûreté – Développement des circuits intégrés programmés  
en HDL –  
Partie 2: Circuits intégrés programmés en HDL pour les systèmes réalisant  
des fonctions de catégorie B ou C**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 27.120.20

ISBN 978-2-8322-8032-4

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	10
2 Normative references .....	11
3 Terms and definitions .....	11
4 Symbols and abbreviated terms.....	18
5 General requirements for HPD projects .....	19
5.1 General.....	19
5.2 Life-cycle .....	19
5.3 Gradation principals.....	21
5.4 HPD quality assurance.....	22
5.4.1 General .....	22
5.5 Configuration management .....	23
5.5.1 General .....	23
5.6 HPD Verification .....	23
6 HPD requirements specification.....	24
6.1 General.....	24
6.1.1 Overview .....	24
6.2 Functional aspects of the requirements specification.....	25
6.2.1 General .....	25
6.3 Fault detection and fault tolerance .....	26
6.4 Requirements capture using Electronic System Level tools.....	26
6.4.1 General .....	26
6.4.2 Requirements on the format of tools used at ESL level.....	27
6.4.3 Interface with design tools.....	27
7 Acceptance process for programmable integrated circuits, native blocks and Pre-Developed Blocks.....	27
7.1 General.....	27
7.2 Acceptance process for programmable integrated circuits and included native blocks.....	27
7.2.1 General.....	27
7.2.2 Integrated Circuit acceptance .....	28
7.3 Acceptance process for PDBs.....	29
7.3.1 General .....	29
7.3.2 PDB functional suitability .....	29
7.3.3 Documentation for safety of PDBs .....	30
7.3.4 Generation of supporting documentation for safety .....	30
7.3.5 Complementary means .....	32
7.3.6 Rules of use .....	32
7.3.7 Modification for acceptance .....	33
8 HPD design and implementation.....	33
8.1 General.....	33
8.2 Hardware Description Languages (HDL) and related tools .....	33
8.2.1 General .....	33
8.3 Design .....	33
8.3.1 General .....	33

8.3.2	Fault detection.....	35
8.3.3	Language and coding rules.....	35
8.3.4	Synchronous vs. asynchronous design.....	36
8.3.5	Power Management.....	37
8.3.6	Design documentation.....	37
8.4	Implementation.....	37
8.4.1	Products.....	37
8.4.2	Files of parameters and constraints.....	37
8.4.3	Post-route analyses.....	37
8.4.4	Redundancies introduced or removed by the tools.....	38
8.4.5	Finite state machines.....	38
8.4.6	Static Timing Analysis.....	38
8.4.7	Implementation documentation.....	38
8.5	System level tools and automated code generation.....	39
8.5.1	General.....	39
9	HPD integration and testing.....	39
9.1	General.....	39
9.2	Test-benches for HPD functional simulation.....	40
9.3	Test coverage.....	40
9.4	Test execution.....	41
10	HPD aspects of system integration.....	41
10.1	General.....	41
10.2	Requirements.....	41
11	HPD aspects of system validation.....	42
11.1	General.....	42
11.2	Requirements.....	42
12	Modification.....	43
12.1	Modification of the requirements, design or implementation.....	43
12.1.1	General.....	43
12.2	Modification of the micro-electronic technology.....	45
13	HPD production.....	45
13.1	General.....	45
13.2	Production tests.....	45
13.3	Programming files and programming activities.....	45
14	HPD aspects of installation, commissioning and operation.....	46
14.1	General.....	46
14.1.1	Overview.....	46
14.2	Anomaly reports.....	46
15	Software tools for the development of HPDs.....	46
15.1	General.....	46
15.1.1	Overview.....	46
15.2	Additional requirements for design, implementation and simulation tools.....	47
16	Design segmentation or partitioning.....	48
16.1	Background.....	48
16.2	Auxiliary or support functions.....	48
16.2.1	General.....	48
16.2.2	Partitioning of auxiliary or support functions or functions of an inferior safety category.....	48

17 Defences against HPD Common Cause Failure .....	49
Annex A (informative) Documentation .....	50
A.1 General.....	50
A.2 Project.....	50
A.3 HPD requirement specification.....	50
A.4 Acceptance of blank integrated circuits, Native Blocks and PDBs .....	50
A.5 HPD design and implementation .....	50
A.6 HPD integration and testing .....	51
A.7 HPD aspects of system integration.....	51
A.8 HPD aspects of system validation .....	51
A.9 Modification .....	51
A.10 HPD production .....	51
A.11 Software tools for the development of HPDs .....	51
Annex B (informative) Development of HPDs .....	52
B.1 General.....	52
B.2 Optional capture of requirements at Electronic System Level .....	52
B.3 HPD and system life-cycle .....	52
B.4 Design .....	53
B.5 Acceptance process for programmable integrated circuits, native blocks and Pre-Developed Blocks.....	54
B.6 Implementation .....	54
B.7 HPD integration and testing .....	55
B.8 Types of specific integrated circuits .....	55
B.8.1 General .....	55
B.8.2 PAL (Programmable Array Logic).....	56
B.8.3 PLD, CPLD (Programmable Logic Device, Complex PLD).....	56
B.8.4 FPGA .....	56
B.8.5 Gate Array, or pre-diffused integrated circuit .....	57
B.8.6 Standard Cells.....	57
B.8.7 “Full custom ASIC” or “raw ASIC” .....	57
Bibliography.....	58
Figure 1 – System life cycle (informative, as defined by IEC 61513) .....	20
Figure 2 – HPD life-cycle .....	21
Figure 3 – Overview of selection and acceptance process for blank Integrated Circuits and native blocks.....	28
Figure 4 – Overview of selection and acceptance process for PDBs .....	29

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS –  
INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY –  
DEVELOPMENT OF HDL-PROGRAMMED INTEGRATED CIRCUITS –**

**Part 2: HDL-programmed integrated circuits  
for systems performing category B or C functions**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, issue IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62566-2 has been prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
45A/1304/FDIS	45A/1314/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62566 series, published under the general title *Nuclear power plants – Instrumentation and control important to safety – Development of HDL-programmed integrated circuits*, can be found on the IEC website.

In this document, the following print types are used:

- *Requirements and recommendations applicable specifically to class 3 or to class 2 systems appear in italics.*

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

Currently in preview, click buy full version

## INTRODUCTION

### a) Technical background, main issues and organisation of the Standard

Electronic systems performing category B and C functions (according to IEC 61226) used in Nuclear Power Plants (NPPs) need to be fully validated and qualified according to their safety class. This International Standard provides requirements for the development of class 2 or 3 HDL (Hardware Description Language) Programmed Devices (HPDs) performing category B or C functions as defined by IEC 61226. It complements IEC 62566 which provides requirements for the development of HPDs performing category A functions.

In computer-based systems, a separation can be drawn between the hardware and software portions. The hardware is mainly designed with standardised components having pre-defined electronic functions such as microprocessors, timers or network controllers, whereas software is used to coordinate the different parts of the hardware and to implement the application functions.

I&C designers might build application functions using integrated circuits such as FPGAs or similar technologies. The function of such an integrated circuit is not defined by the supplier of the physical component or micro-electronic technology but by the I&C designer.

The specific integrated circuits addressed by this Standard are:

- a) based on pre-developed micro-electronic technologies,
- b) developed within an I&C project,
- c) developed in Hardware Description Languages (HDL) by using appropriate and compatible development tools.

Therefore these circuits are named “HDL-Programmed Devices”, (HPD). The HDL statements which describe a HPD can include the instantiation of Pre-Developed Blocks (PDB) which are typically provided as libraries, macros, or intellectual property cores.

HPDs can be effective solutions to implement functions required by an I&C project. However, the verification and validation might be limited by issues such as high number of internal paths and limited observability, if the HPD has not been developed with verifiability in mind.

In order to achieve the reliability required for safety I&C systems, the development of HPDs shall comply with strict process and technical requirements such as those provided by this Standard, including the specification of requirements, the selection of blank integrated circuits and PDBs, the design and implementation, the verification, and the procedures for operation and maintenance.

It is intended that this Standard be used by HPD designers, operators of NPPs (utilities), and by regulators. Regulatory bodies will find guidance to assess important aspects such as design, implementation, verification and validation of HPDs.

### b) Situation of the current Standard in the structure of the IEC SC 45A standard series

IEC 61513 is a first level IEC SC 45A document and gives guidance applicable to I&C at the system level. It is supplemented by guidance at the hardware level (IEC 60987), software level (IEC 60880 and IEC 62138) and HPD level (IEC 62566 and IEC 62566-2). IEC 62340 gives requirements in order to reduce and overcome the possibility of common cause failure of category A functions.

IEC 62566-2 is a second level IEC SC 45A document which focuses on the activities when HPDs performing category B or C functions are developed. For HPDs performing category B functions, it complements IEC 60987 which deals with the generic issues of hardware design of computer-based systems.

### **c) Recommendations and limitations regarding the application of the Standard**

It is important to note that this Standard establishes no additional functional requirements for safety systems.

Aspects for which special requirements and recommendations have been produced are:

- a) an approach to specify the requirements of, to design, to implement and to verify “Hardware Programmed Devices” (HPD, 3.20), and to handle the corresponding aspects of system integration and validation;
- b) an approach to analyse and select the blank integrated circuits, micro electronic technologies and Pre-Developed Blocks (PDB, 3.29) used to develop HPDs;
- c) procedures for the modification and configuration control of HPDs;
- d) requirements for selection and use of software tools used to develop HPDs.

It is recognized that digital technology is continuing to develop at a rapid pace and that it is not possible for a Standard such as this one to include references to all modern design technologies and techniques.

To ensure that the Standard will continue to be relevant in future years the emphasis has been placed on issues of principle, rather than specific technologies. If new techniques are developed then it should be possible to assess the suitability of such techniques by applying the safety principles contained within this Standard.

### **d) Description of the structure of the IEC SC 45A standard series and relationships with other IEC documents and other bodies documents (IAEA, ISO)**

The top-level documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046. IEC 61513 provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 63046 provides general requirements for electrical power systems of NPPs, it covers power supply systems including the supply systems of the I&C systems. IEC 61513 and IEC 63046 are to be considered in conjunction and at the same level. IEC 61513 and IEC 63046 structure the IEC SC 45A standard series and shape a complete framework establishing general requirements for instrumentation, control and electrical systems for nuclear power plants.

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general topics related to categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, cybersecurity, software and hardware aspects for programmable digital systems, coordination of ageing and security requirements and management of ageing. The standards referenced directly at this second level should be considered together with IEC 61513 and IEC 63046 as a consistent document set.

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 or by IEC 63046 are standards related to specific equipment, technical methods, or specific activities. Usually these documents, which make reference to second-level documents for general topics, can be used on their own.

A fourth level extending the IEC SC 45 standard series, corresponds to the Technical Reports which are not normative.

The IEC SC 45A standards series consistently implements and details the safety and security principles and basic aspects provided in the relevant IAEA safety standards and in the relevant documents of the IAEA Nuclear Security Series (NSS). In particular this includes the IAEA requirements SSR-2/1, establishing safety requirements related to the design of Nuclear Power Plants (NPPs), the IAEA safety guide SSG-30 dealing with the safety classification of structures, systems and components in NPPs, the IAEA safety guide SSG-39 dealing with the design of instrumentation and control systems for NPPs, the IAEA safety guide SSG-34 dealing with the design of electrical power systems for NPPs and the implementing guide NSS17 for computer security at nuclear facilities. The safety and security terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

IEC 61513 and IEC 63046 have adopted a presentation format similar to the basic safety publication IEC 61508 with an overall life-cycle framework and a system life-cycle framework. Regarding nuclear safety, IEC 61513 and IEC 63046 provide the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector. In this framework IEC 60880, IEC 62138 and IEC 62566 correspond to IEC 61508-3 for the nuclear application sector. IEC 61513 and IEC 63046 refer to ISO as well as to IAEA GS-R part 2 and IAEA GS-G-3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA). At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC/SC 45A security standards. It builds upon the valid high level principles and main concepts of the generic security standards, in particular ISO/IEC 27001 and ISO/IEC 27002; it adapts them and completes them to fit the nuclear context and coordinates with the IEC 62443 series. At level 2, IEC 60964 is the entry document for the IEC/SC 45A control rooms standards and IEC 62342 is the entry document for the ageing management standards.

NOTE 1 It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards) international or national standards would be applied.

NOTE 2 IEC/SC 45A domain was extended in 2013 to cover electrical systems. In 2014 and 2015 discussions were held in IEC/SC 45A to decide how and where general requirement for the design of electrical systems were to be considered. IEC/SC 45A experts recommended that an independent standard be developed at the same level as IEC 61513 to establish general requirements for electrical systems. Project IEC 63046 is now launched to cover this objective. When IEC 63046 is published this NOTE 2 of the introduction of IEC/SC 45A standards will be suppressed.

# **NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY – DEVELOPMENT OF HDL-PROGRAMMED INTEGRATED CIRCUITS –**

## **Part 2: HDL-programmed integrated circuits for systems performing category B or C functions**

### **1 Scope**

This part of IEC 62566 provides requirements for achieving highly reliable HDL-Programmed Devices (HPDs), for use in I&C systems of nuclear power plants performing functions of safety category B or C as defined by IEC 61226.

The programming of HPDs relies on Hardware Description Languages (HDL) and related software tools. They are typically based on blank Field Programmable Gate Arrays (FPGAs) or similar micro-electronic technologies such as Programmable Logic Devices (PLD), Complex Programmable Logic Devices (CPLDs), etc. General purpose integrated circuits such as microprocessors are not HPDs. Annex B.8 provides descriptions of a number of different types of integrated circuits.

This document provides requirements on:

- a) a dedicated HPD life-cycle addressing each phase of the development of HPDs, including specification of requirements, design, implementation, integration and validation, as well as verification activities associated with each phase,
- b) planning and complementary activities such as modification and production,
- c) selection of pre-developed components. This includes micro-electronic technologies and Pre-Developed Blocks (PDBs),
- d) tools used to design, implement and verify HPDs.

This document does not put requirements on the development of the micro-electronic technologies, which are usually available as "commercial off-the-shelf" items and are not developed under nuclear quality assurance standards. It addresses the developments made with these micro-electronic technologies in an I&C project with HDLs and related tools.

This document provides guidance to avoid as far as possible latent faults remaining in HPDs, and to reduce the susceptibility to single failures as well as to potential Common Cause Failures (CCFs).

Reliability aspects related to environmental qualification and failures due to ageing or physical degradation are not handled in this document. Other standards, especially IEC 60987, IEC/IEEE 60780-323 and IEC 62342, address these topics.

This document does not cover cybersecurity for HDL aspects of I&C systems. IEC 62645 provides requirements for security programmes for I&C programmable digital systems.

This document provides guidance and requirements to produce verifiable HPD designs and implementations requiring justification due for their role in carrying out category B or C safety functions. This document describes the activities to develop HPDs, organized in the framework of a dedicated life-cycle. It also describes activities and guidelines to be used in addition to the requirements of IEC 61226 for system classification and IEC 61513 for system integration and validation when HPDs are included.